Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 July and 30 September 2005

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Background

The U.S. Atlantic pelagic longline fleet operates throughout the Northwestern Atlantic Ocean including along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the central North Atlantic Ocean. The longline fishery has a documented history of incidental takes of non-target species including billfish, marine turtles, and marine mammals. A Biological Opinion on the pelagic longline fishery was recently developed by the National Marine Fisheries Service under the Endangered Species Act requiring several actions to be taken to improve monitoring and reduce interactions with leatherback and loggerhead turtles. These regulations reopened the northeast distant (NED) water fishing area, with restrictions, on June 30, 2004 and similar restrictions were imposed upon the rest of the fleet effective August 5, 2004. These regulations mandate that all longline gear use 16/0 or 18/0 circle hooks and eliminates J-hooks from the fishery. This quarterly report includes fishing under the new regulatory regime.

The biological opinion required quarterly reporting of interactions with protected species including marine mammals and marine turtles. The goal of this measure is to more closely monitor any potential short-term increases in interaction rates and thereby allow a more responsive management program. This report meets this requirement and includes the observed fishery effort and incidental takes observed by the pelagic longline observer program (POP) including sets from July 1, 2005 to September 30, 2005.

During quarter 3 of 2005, a cooperative research program (CRP) was conducted aboard six pelagic longline fleet vessels operating in the Gulf of Mexico, Florida East Coast, mid-Atlantic Bight, South Atlantic Bight, and Northeast Coastal fishing areas. These trips all had 100% observer coverage. In this project, fishermen conducted experimental fishing activities employing different hook baiting techniques and attaching hook timers and time-depth recorders to the fishing gear. The fishing gear used in this experiment also employed standardized gangion lengths, float line lengths, and other gear characteristics to reduce bias among various experimental treatments. Therefore, the fishing techniques and gear employed during the experimental fishery do not represent those used during "normal" fishing effort, and it would be inappropriate to extrapolate bycatch rates observed in these sets across the rest of the reported fishing effort for the quarter. Observed protected species bycatch, and the resulting bycatch

rates, are therefore separated between experimental and normal fishing observed during this quarter.

While it is desirable to estimate the absolute level of takes (i.e., total number of turtles taken), this is not currently possible because the fishery effort data is reported on logbook forms by fishing captains. These data are not available until several months after the end of any given quarter primarily due to delays in reporting by the vessel captains. Therefore, I present the bycatch rate (i.e., catch per unit effort) based upon observer data as an indicator of the relative level of interactions with protected species. The observed bycatch rate by fishing area during 2005 is compared to that observed in 2004 (Garrison, 2004) and the average of the previous five years (2000-2004) to assess whether or not the observed rate in 2005 is unusually high or low. Bycatch rates are calculated applying the delta log-normal method using hooks as the unit of effort, and the analytical methods are described in detail in Garrison (2003).

Results and Discussion

A total of 119 longline sets (~94,500 hooks) were observed during quarter 3 of 2005 (Table 1) in "normal" fishing operations. The experimental fishery included an additional 120 observed sets (~84,000 hooks). The Gulf of Mexico and the mid-Atlantic Bight had the highest number of observed sets.

During normal fishing operations, there were 3 observed interactions with leatherback turtles and 4 interactions with loggerhead turtles (Table 2). All turtles were listed as released alive and injured because they were hooked (Appendix A1). The locations of observed sets and turtle interactions are shown in Figure 1. An additional 10 leatherback turtle and 8 loggerhead turtle interactions were observed during experimental fishing (Table 2, Appendix A2)

There were 11 observed interactions with pilot whales in the MAB area during this quarter (Table 3, Figure 3), all occurring during normal fishing operations. Five of these animals were seriously injured based upon observer comments and serious injury criteria (see Garrison, 2003; Angliss and Demaster, 1998). One interaction with an un-identified mammal was observed in the Gulf of Mexico.

The quarterly and regional bycatch rates during normal fishing operations are summarized for turtles in Table 4 and for marine mammals in Table 5. These rates are compared with those from the same quarter/area for 2004 and the average from 2000-2004 in Tables 6-7. Specific information on injuries to sea turtles and gear characteristics of each interaction are shown in Appendix A1 and A2.

Leatherback turtles were caught only in the MAB and NED areas. The bycatch rates observed during quarter 3, 2005 are lower than those of 2004 and the previous five year average in the mid-Atlantic Bight. The bycatch rate for leatherbacks observed in the NED were consistent with that observed in 2004 and was elevated compared to the 2000-2004 average (Table 6a).

Loggerhead turtles were caught in the MAB and SAB areas, and the bycatch rates were generally consistent with those observed in previous years. The lack of observer coverage of normal

fishing in the NEC may be significant, as this area has had a generally high bycatch rate in the 3rd quarter in previous years (Table 6b).

Only circle hooks (16/0 and 18/0) were observed during this quarter, consistent with recent regulations for this fishery. Concerted efforts by fishermen to remove hooks and disentangle captured turtles are also mandated by the Biological Opinion. All 3 leatherback turtles captured during this quarter in normal fishing were hooked in the armpit or on the shoulder. In 1 of these 3 leatherback turtles, the hook was successfully removed and 1 leatherback was released with trailing gear but was not entangled (Appendix A1). The four loggerhead turtles were hooked in the mouth and lower jaw (n=3) or swallowed the hook (n=1). The hooks were removed for three turtles, but not for the turtle that swallowed the hook (Appendix A1).

During experimental fishing, 6 of the 10 leatherbacks were hooked externally in the front flipper, shoulder, groin, or beak. The hook was removed in 5 out of 6 cases. Only 1 leatherback was released with trailing line (Appendix A2). Seven of the eight loggerheads were hooked, generally in the mouth and tongue. The hook was removed in 6 of the 7 cases.

The bycatch (and serious injury) rates of pilot whales during this quarter was unusually high. The MAB fishing area typically has the highest and most consistent bycatch of pilot whales during the previous five years. The observed bycatch rate during quarter 3 of 2005 in normal fishing operations was more than three times higher than that observed in the previous five years (Table 7).

There are a number of caveats and uncertainties associated with the current analysis. First, while these data have gone through an initial audit and review, they are subject to change upon further review after the end of the 2005 calendar year. Second, the delta log-normal estimator was applied to calculate bycatch consistent with previous estimates (e.g., Garrison 2003). This approach assumes 1) that catch rates (animals per hook) are lognormally distributed and 2) that the number of hooks is an appropriate unit of effort. The first assumption has been evaluated for turtles; however, violations of this assumption may result in biased (positive or negative) estimates of catch rate and associated variances. The second assumption has not been examined critically in previous analyses. If this assumption is not correct, for example if there are saturation effects resulting in a non-linear relationship between the number of hooks and total catch, then there is potentially a bias in the estimate of bycatch rate and total bycatch.

The interaction between longline gear and protected species is a relatively rare event and is therefore inherently variable. Historically, there have been very large interannual fluctuations in bycatch rates and estimates of total bycatch. Thus, any differences observed between short term observations of bycatch rates and long term averages may be stochastic events and are not necessarily indicative of a significant change in the interactions between the longline fishery and protected species.

Literature Cited

Angliss, R.P. and D.P. DeMaster. 1998. Differentiating serious and non-serious injury of marine mammals taken incidental to commercial fishing operations. NOAA Technical Memorandum NMFS-OPR-13: 48 p.

Garrison, L.P. 2003. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2001-2002. NOAA Technical Memorandum NOAA FISHERIES-SEFSC-515: 52 p.

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Table 1. Number of sets and hooks (x1000) observed in the U.S. Atlantic Pelagic Longline Fishery between 1 July – 30 September, 2005 by fishing area during (A) Normal and (B) Experimental Fishery Operations.

A. Normal Fishing

Area	Sets	Hooks (x 1000)
CAR	0	0
FEC	0	0
GOM	48	40.89
MAB	42	31.83
NCA	0	0
NEC	0	0
NED	14	14.13
SAB	15	7.68
SAR	0	0
TUN	0	0
TUS	0	0
Total	**119**	**94.53**

B. Experimental Fishing

Area	Sets	Hooks (x 1000)
CAR	0	0
FEC	9	4.44
GOM	51	33.07
MAB	4	3.70
NCA	0	0
NEC	43	36.7
NED	0	0
SAB	13	5.82
SAR	0	0
TUN	0	0
TUS	0	0
Total	**120**	**83.73**

Table 2. Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning between 1 July – 30 September, 2005 by fishing area during (A) Normal and (B) Experimental fishery operations. All turtles were recorded as being released alive. Areas with missing values indicate no observer coverage during this time period.

(A) Normal Fishing

Area	Leatherback	Loggerhead
CAR	-	-
FEC	-	-
GOM	0	0
MAB	1	3
NCA	-	-
NEC	-	-
NED	2	0
SAB	0	1
SAR	-	-
TUN	-	-
TUS	-	-
Total	**3**	**4**

(B) Experimental Fishing

Area	Leatherback	Loggerhead
CAR	-	-
FEC	1	0
GOM	2	0
MAB	0	0
NCA	-	-
NEC	7	8
NED	-	-
SAB	0	0
SAR	-	-
TUN	-	-
TUS	-	-
Total	**10**	**8**

Table 3. Interactions with marine mammals observed during 1July – 30 September 2005 in the U.S. Atlantic Pelagic Longline Fishery. Observer comments and criteria described in Angliss and DeMaster (1998) were used to evaluate serious injury.

Species	Region	Experiment	# Released Un-injured	# Dead	# Serious Injury
Un-id. Marine Mammal	GOM	No	0	0	1
Pilot Whale	MAB	No	6	0	5

Table 4. Estimated bycatch rate (Catch per 1000 hooks) for (A) Leatherback and (B) Loggerhead turtles by geographic area and during 1 July – 30 September, 2005 in the U.S. Atlantic Pelagic longline fishery during normal fishing operations. Missing values indicate areas with no observer coverage. CV indicates the coefficient of variation of the estimated rate. All turtles were recorded as released alive.

A. Leatherback Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	0	-	-	-	-
GOM	48	0	0	-	-
MAB	42	1	0.0310	0.0009	1.000
NCA	0	-	-	-	-
NEC	0	-	-	-	-
NED	14	2	0.1417	0.0093	0.679
SAB	15	0	-	-	-
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

B. Loggerhead Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	0	-	-	-	-
GOM	48	0	0	-	-
MAB	42	3	0.1026	0.0037	0.5906
NCA	0	-	-	-	-
NEC	0	-	-	-	-
NED	14	0	0	-	-
SAB	15	1	0.1201	0.0144	1.000
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

Table 5. Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area and quarter during 1 July – 30 September, 2005 in the U.S. Atlantic Pelagic longline fishery during normal fishery operations. CV indicates the coefficient of variation of the estimated rate.

Species	Serious Injury ?	Area	# Positive Sets	# Observed Sets	Mean CPUE	Var CPUE	CV
Un-id. Marine Mammal	Y	GOM	1	48	0.0248	0.0006	1.000
Pilot Whale	N	MAB	3	42	0.2006	0.0139	0.5878
Pilot Whale	Y	MAB	5	42	0.1887	0.0084	0.4860

Table 6. Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic longline fishery during 1 July- 30 September, 2005 and comparison to 2004 and the average rate from 2000-2004. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates.

A. Leatherback turtles

Area	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000-2004 CPUE	2000-2004 95% CI
CAR	-	-	-	-	-	-
FEC	-	-	0	-	0.04539	0.0093-0.2219
GOM	0	-	0.0601	0.0243 – 0.1490	0.1444	0.1006-0.2073
MAB	0.0310	0.0063-0.1516	0.1841	0.0526 – 0.6440	0.0587	0.0204-0.1688
NCA	-	-	-	-	-	-
NEC	-	-	0	-	0.0256	0.0076-0.0864
NED[1]	0.1417	0.0438-0.4585	0.2315	0.1291 – 0.4153	0.0232	0.0139-0.0389
SAB	-	-	0	-	0.2003	0.07954-0.5042
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

B. Loggerhead Turtles

Area	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000-2004 CPUE	2000 - 2004 95% CI
CAR	-	-	-	-	-	-
FEC	-	-	0	-	0	-
GOM	0	-	0.0130	0.0027 – 0.0633	0.0162	0.0066-0.0399
MAB	0.1026	0.0362-0.2910	0.1493	0.0437 – 0.5098	0.1598	0.0786-0.3247
NCA	-	-	-	-	-	-
NEC	-	-	0.2888	0.1203 – 0.6934	0.2966	0.1978-0.4448
NED[1]	0	-	0.1351	0.0549 – 0.3327	0.0219	0.0121-0.3951
SAB	0.1201	0.0246-0.5872	0	-	0.0522	0.0107-0.2552
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

[1] Fishery effort in the NED region during 2001, 2002, and 2003 followed an experimental design distinct from "normal" fishery operations.

Table 7. Summary of bycatch rates for marine mammals in the U.S. Atlantic longline fishery during 1 July – 30 September, 2005 and comparison to rates from the previous year (2004) and the average of the previous five years (2000-2004). 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. CPUEs reflect total marine mammals caught including alive, dead, and seriously injured animals.

Species	Area	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000 - 2004 CPUE	2000-2004 95% CI
Unid. Marine Mammal	GOM	0.0248	0.0051 – 0.1212	0	-	0	-
Common Dolphin	MAB	0	-	0	-	0.0121	0.0025-0.0591
Risso's Dolphin	MAB	0	-	0	-	0.0094	0.0019-0.0461
Pilot Whale	MAB	0.3987	0.1633 – 0.9734	0.1356	0.0409 – 0.4491	0.1209	0.0557-0.2622
Common Dolphin	NEC	0	-	0	-	0.0250	0.0051-0.1222
Risso's Dolphin	NEC	0	-	0.0535	0.0109 – 0.2614	0.0278	0.0083-0.0933
Pilot Whale	NEC	0	-	0	-	0.0145	0.003-0.0707
Unid. Whale	NEC	0	-	0	-	0.0150	0.0031-0.0732
Unid. Dolphin	NED[1]	0	-	0	-	0.0025	0.0007-0.0085
Common Dolphin	NED[1]	0	-	0.0184	0.0038 – 0.0902	0.0023	0.0007-0.0076
Risso's Dolphin	NED[1]	0	-	0	-	0.0124	0.0067-0.0229
Striped Dolphin	NED[1]	0	-	0	-	0.0009	0.0002-0.0042
Baleen Whale	NED[1]	0	-	0	-	0.0010	0.0002-0.0051
Risso's Dolphin	SAB	0	-	0	-	0.1026	0.0308-0.3424

[1] Fishery effort in the NED region during 2001, 2002, and 2003 followed an experimental design distinct from "normal" fishery operations.

Figure 1. Observed Pelagic Longline effort and turtle interactions during 1 July – 30 September, 2005. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

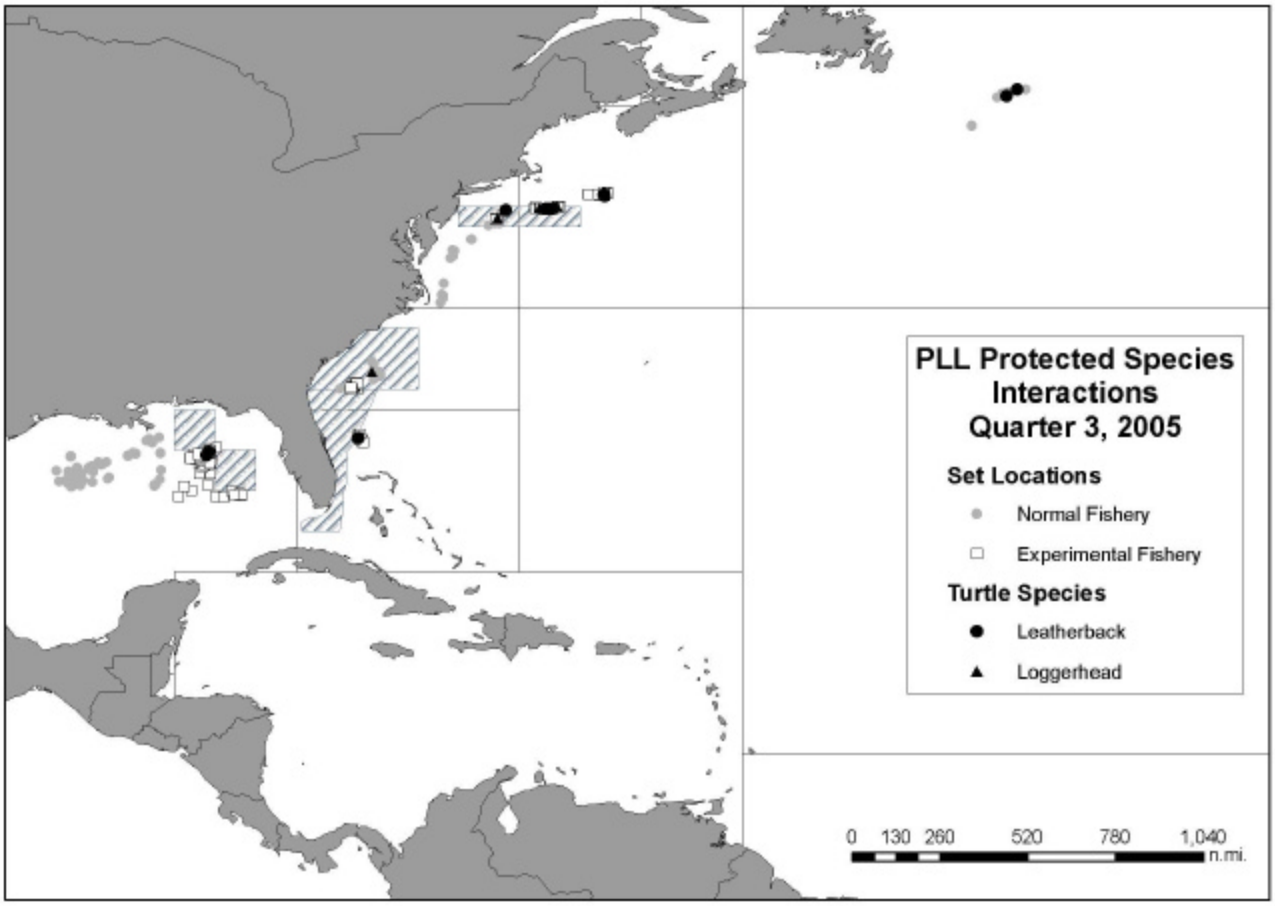
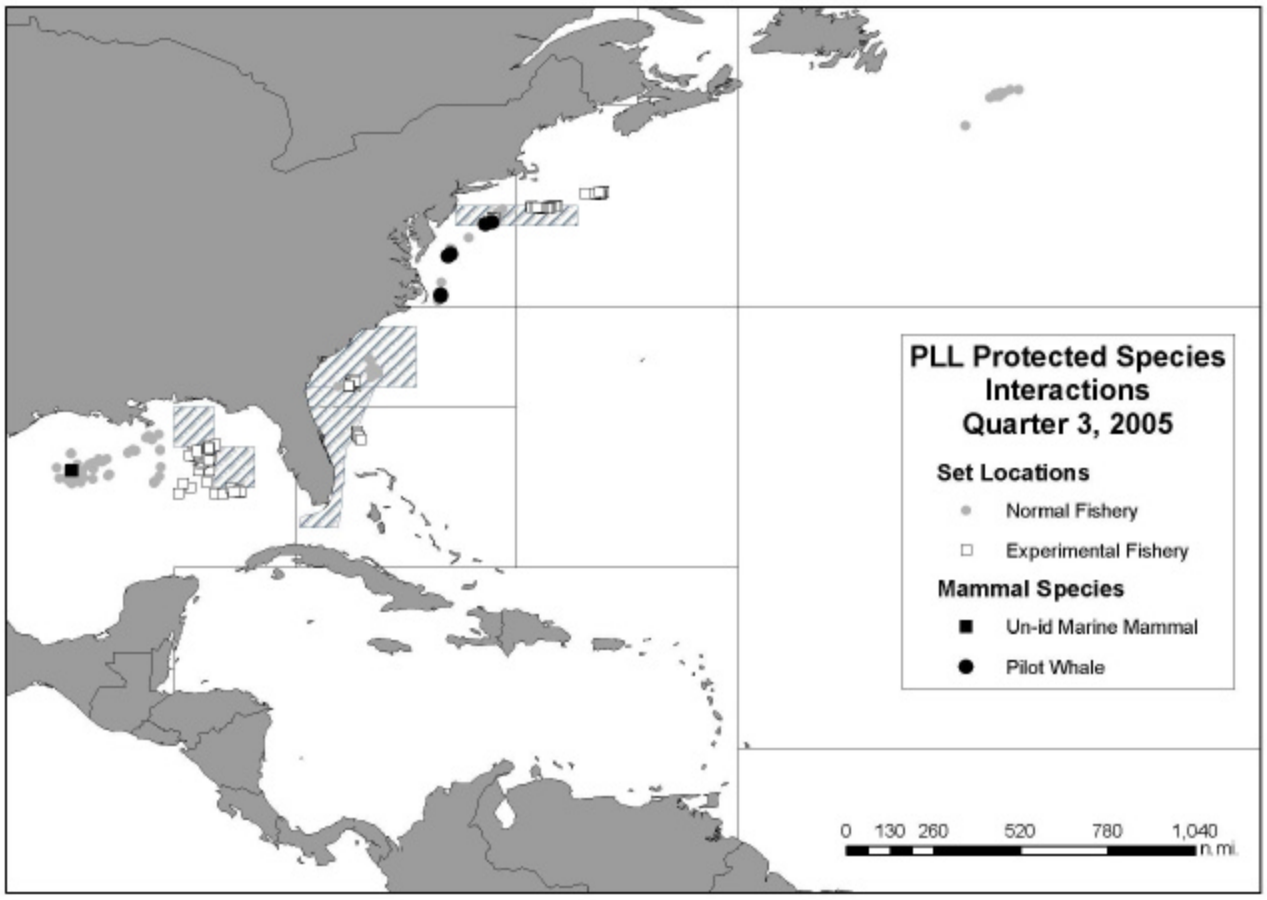


Figure 2. Observed Pelagic Longline effort and marine mammal interactions during 1 July – 30 September, 2005. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.



Appendix A1: Injury details and hook type for turtles captured in the pelagic longline fishery for sets beginning during 1 July – 30 September, 2005 during normal fishing operations

A. Leatherback Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	MAB	C-16/0	0	squid or mackerel	205 or 425g	Alive, injured	front flipper/ shoulder/ armpit	n/a	n/a	No	unknown	unknown	5.00	4.50		
2	NED	C-18/0	10	mackerel	315g	Alive, injured	armpit	n/a	n/a	Yes	No	No	0.00		155	
3	NED	C-18/0	10	mackerel	315g	Alive, injured	armpit	n/a	n/a	Yes	No	No	0.00	4.50		

B. Loggerhead Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	SAB	C-16/0	0	squid or mackerel	348 or 426g	Alive, injured	mouth	lower other	n/a	Yes	No	No	0.00			64.5
2	MAB	C-18/0	10	squid	204 g	Alive, injured	mouth	lower other	n/a	Yes	No	No	0.00		69.5	63.9
3	MAB	C-16/0	0	squid	200 g	Alive, injured	swallowed	n/a	partial hook	No	No	No	0.00		66.6	61.6
4	MAB	C-16/0	0	squid	203g	Alive, injured	mouth	lower other	n/a	Yes	No	No	0.00		66.2	59

Appendix A2: Injury details and hook type for turtles captured in the pelagic longline fishery for sets beginning during 1 July – 30 September, 2005 during experimental fishing operations

A. Leatherback turtles.

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	NEC	C-18/0	n/a	squid	219g	Alive, uninjured	not hooked	n/a	n/a	n/a	Yes	No	0.00	4.80		
2	FEC	C-18/0	10	mackerel	370g	Alive, injured	groin	n/a	n/a	No	No	No	2.00	6.00		
3	GOM	C-16/0	0	sardines	86.5g	Alive, uninjured	not hooked	n/a	n/a	n/a	Yes	No	0.00	4.00		
4	NEC	C-18/0	0	squid	219g	Alive, injured	front flipper	n/a	n/a	Yes	Yes	No	0.00	4.30		
5	NEC	C-18/0	10	squid	219g	Alive, injured	front flipper	n/a	n/a	Yes	No	No	0.00	4.40		
6	NEC	C-18/0	10	squid	219g	Alive, injured	shoulder	n/a	n/a	Yes	No	No	0.00	4.40		
7	NEC	C-18/0	n/a	squid	236g	Alive, uninjured	not hooked	n/a	n/a	n/a	Yes	No	0.00	4.00		
8	NEC	C-18/0	0	mackerel	358g	Alive, injured	beak external	n/a	n/a	Yes	Yes	No	0.00	5.30		
9	NEC	C-18/0	0	mackerel	358g	Alive, injured	shoulder	n/a	n/a	Yes	Yes	No	0.00	5.30		
10	GOM	C-16/0	0	sardines	91g	Alive, uninjured	not hooked	n/a	n/a	n/a	Yes	No	0.00	4.50		

Appendix A2 cont.
B. Loggerhead turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	NEC	C-18/0	0	squid	204g	Alive, injured	mouth	lower other	n/a	Yes	No	No	0.00		75.2	65.5
2	NEC	C-18/0	10	squid	204 g	Alive, injured	mouth	unknown	n/a	Yes	No	No	0.00	2.10		
3	NEC	C-18/0	10	squid	204g	Alive, injured	mouth	unknown	n/a	Yes	No	No	0.00	2.30		
4	NEC	C-18/0	0	mackerel	340g	Alive, injured	tongue	lower	n/a	Yes	No	No	0.00		66.5	60.4
5	NEC	C-18/0	0	squid	219g	Alive, injured	swallowed	n/a	not visible	No	No	No	0.50		68.2	60.5
6	NEC	C-18/0	10	mackerel	477g	Alive, injured	beak internal	upper other	n/a	Yes	No	No	0.00		63	56.2
7	NEC	C-18/0	0	squid	218g	Alive, injured	beak internal	upper	n/a	Yes	No	No	0.00		65	58
8	NEC	C-18/0	0	squid	358g	Alive, uninjured	not hooked	n/a	n/a	n/a	Yes	No	0.00		73.6	67.2